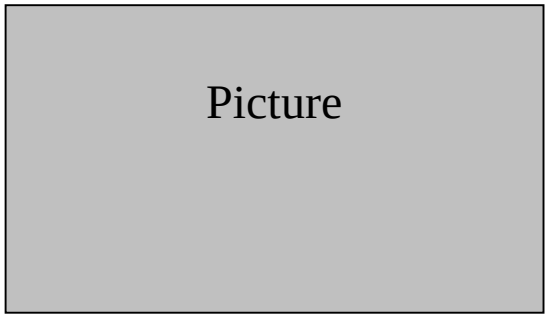
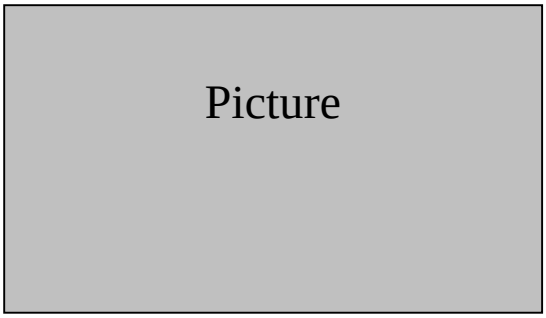
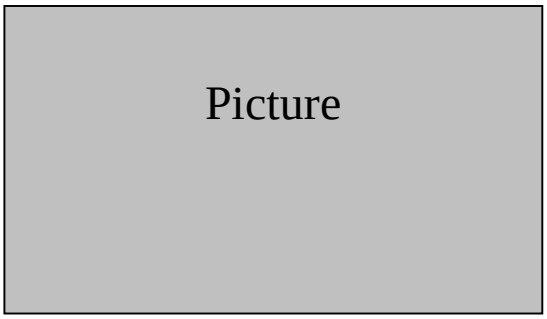
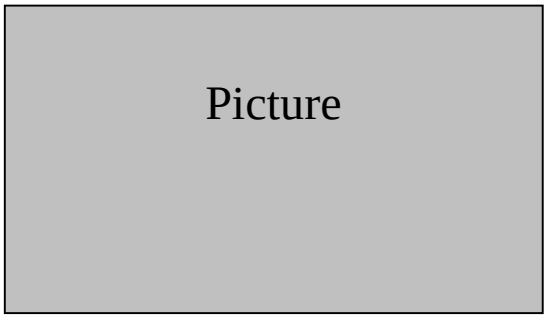
NASA Glenn Research Center
Strategic Implementation Plan

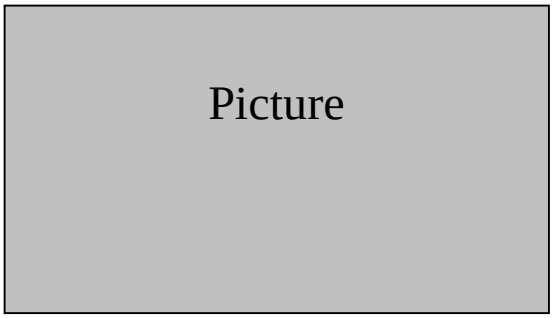
Fiscal Year 2002











National Aeronautics and Space Administration
John H. Glenn Research Center at Lewis Field
Cleveland, Ohio

Center Director's Message

The Glenn Research Center (GRC) Strategic Implementation Plan summarizes the Center's primary objectives and milestones supporting NASA's Enterprises and Crosscutting Processes in fiscal year 2002.

This plan addresses the needs of GRC's primary customers, who are our Nation's businesses, academia, the Department of Defense, and the Federal Aviation Administration. This plan addresses the needs of GRC's primary stakeholders, who are Congress, the Administration, state and local government entities in Ohio and the Great Lakes region, and, of course, NASA Headquarters and the other NASA centers—all of whom also are GRC's customers.

To successfully satisfy these customer and stakeholder needs, we at GRC must not only commit ourselves to implementing this plan but also to practicing the key values of quality, openness, diversity, and integrity. We also must commit ourselves to innovation and continuous improvement so that we will always provide quality products and excellent services for safe and reliable aeronautics, aerospace, and space applications. These commitments will benefit our Center, NASA, our Nation, and the world.

Donald J. Campbell
Director

Robert E. Fails
Chief Financial Officer

Gerald J. Barna
Acting Deputy Director

Rick J. Bailer
Deputy Chief, Office of Human Resources

Julian M. Earls
Deputy Director for Operations

Vernon W. Wessel
Director of Safety and Assurance Technologies

Marvin E. Goldstein
Chief Scientist

Arun K. Sehra
Director of Aeronautics

John W. Gaff
Assistant Deputy Director for Policy

Woodrow Whitlow, Jr.
Director of Research and Technology

J. William Sikora
Chief Counsel

Rudolph L. Saldana
Acting Director of Space

Gary T. Seng
Chief, Aeropropulsion Research Program Office

Randall B. Furnas
Director of Engineering and Technical Services

Olga D. Gonzalez-Sanabria
Chief, Systems Management Office

Sasi K. Pillay
Chief Information Officer

Robert Romero
Chief, Office of Equal Opportunity Programs

John M. Hairston, Jr.
Director of External Programs

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Front Cover–
Lower Left: _____represents GRC contributions to Space Science

Upper Left: _____ represents GRC contributions to Human Exploration and Development of Space

Center: _____represents GRC contributions to Aerospace Technology

Lower Right:_____represents GRC contributions to Earth Science

Upper Right: _____represents GRC contributions to Biological and Physical Research

Introduction

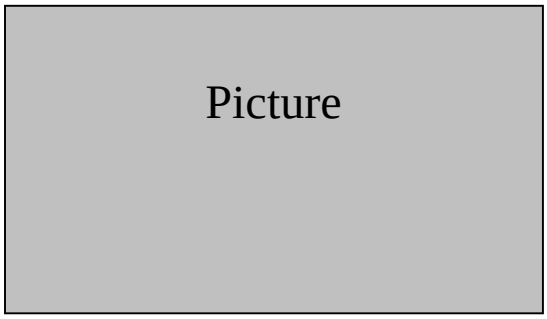
The Purposes of This Plan

The Government Performance and Results Act of 1993 requires agencies to conduct long-term strategic planning, measure program outcomes, and be accountable for achieving program results. Accordingly, NASA has developed a Strategic Plan that articulates its activities, goals, customers, and methods for successfully accomplishing its mission.

The purposes of the GRC Strategic Implementation Plan are to

- Delineate GRC's fiscal year objectives and milestones to support NASA's Strategic Plan and Annual Performance Plan
- Communicate to GRC employees their expected contributions to the Agency and the Center
- Assure GRC's customers and stakeholders that their needs are being met
- Provide performance measures and indicators for GRC

The diagram below shows that the elements of the NASA Strategic Plan and Annual Performance Plan cascade to the NASA GRC Strategic Implementation Plan and subsequently to program plans and individual employee performance plans.



The NASA Vision

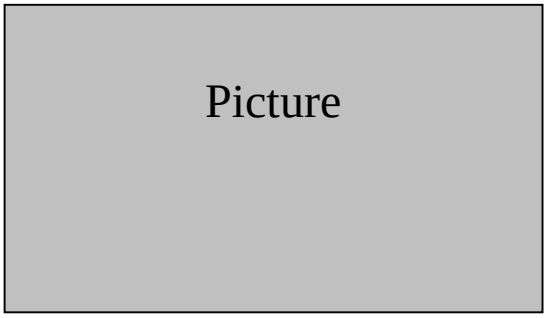
NASA is an investment in America's future. As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.

The NASA Mission

- To advance and communicate scientific knowledge and understanding of Earth, the solar system, and the universe
- To advance human exploration, use, and development of space
- To research, develop, verify, and transfer advanced aeronautics, space, and related technologies

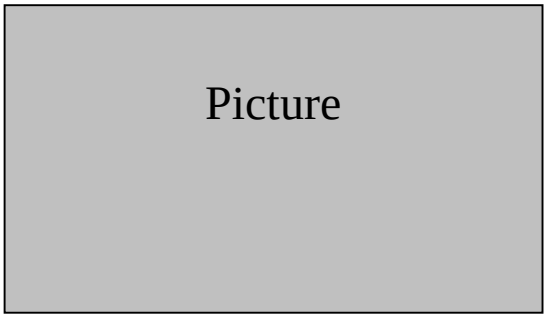
The GRC Mission

As a diverse team working in partnership with government, industry, and academia to increase national wealth, safety, and security, protect the environment, and explore the universe, we develop and transfer critical technologies that address national priorities through research, technology development, and systems development for safe and reliable aeronautics, aerospace, and space applications.



Model Workplace Goal

The model workplace represents the goal state where the full integration of Glenn's key values (diversity, quality, openness, and integrity) is adequately demonstrated. It is the type of workplace where all people at Glenn feel valued for their contributions to the Center's goals and are rewarded fairly for their achievements; where work is an energizing and motivating experience free from racism, sexism, and other "isms" that divide and denigrate groups and individuals; where all persons enjoy personal fulfillment in their careers; where Glenn is frequently visited for benchmarking by other U.S. organizations because of the excellence of its culturally diverse staff and management; where customers, stakeholders, and staff recognize the benefits of its culturally diverse workforce.



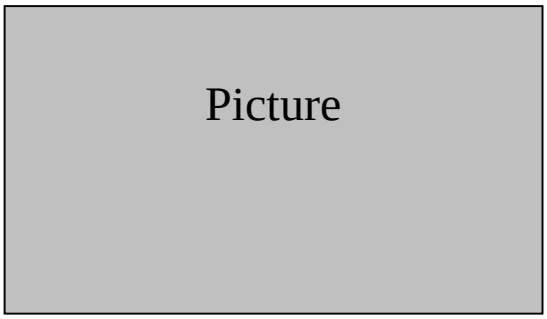
Agency Safety Initiative

The NASA Agency Safety Initiative is a cornerstone element for all programmatic and institutional activities at GRC. The overall goal of this policy is “Making NASA the Nation’s leader in the safety and occupational health of its workforce and in the safety of the products and services it provides.” In response to this goal, GRC has initiated comprehensive efforts to implement an effective safety and health program, which includes provisions for the systematic identification, evaluation, and prevention or control of hazards—general and specific—arising from foreseeable conditions in the workplace.

Four NASA core process requirements vital to the success of the Agency Safety Initiative are

- Management commitment and employee involvement
- Worksite hazard analysis
- Hazard prevention and control
- Safety and health training

In response to these requirements, the Glenn Research Center program stresses enhanced safety practices in the workplace and improved safety awareness by management and staff. A systematic approach to safety and health risk identification has been introduced and is being applied to all systems, equipment, and facilities. Program and project managers now include the prevention and control of safety and health hazards as essential elements of their risk strategies, and GRC’s industrial and academic partners have also been recruited in the pursuit of these goals. More comprehensive training of managers and staff has begun to better recognize and control workplace hazards and hazardous situations. This coordinated effort will enable GRC to meet the NASA Administrator’s goals in this most important element of the NASA mission.



GRC Core Competencies

The Glenn Research Center implements Agency goals and strategies by building and maintaining critical skills, capabilities, and business functions to support basic research and technology development. Although there are many overarching competencies that are critical to the success of the Center, GRC previously focused on four *technology* core competencies. However, in concert with recent Agency initiatives and in recognition of the creation of NASA's new Biological and Physical Research Enterprise, GRC has expanded these core competencies to recognize the Center's unique expertise and contributions to *scientific* research. These three new science core competencies combine with the four technology core competencies to enable GRC to fully support all five NASA Enterprises.

Listed below are the Center's core competencies and their corresponding strategic thrusts:

Technology Core Competencies

Aeropropulsion Systems

- Improve turbomachinery components, propulsion systems
- Develop improved aerodynamics and mission analysis tools
- Develop improved materials and structural concepts
- Reduce propulsion system noise and emissions
- Increase propulsion system efficiency
- Improve harsh environment instrumentation and sensors

Aerospace Power and Electric Propulsion

- Ability to propel spacecraft on science and exploration missions
- Provide transit and surface power to NASA missions
- Create technology in power and electric propulsion to enhance and enable NASA missions
- Provide system analysis, modeling and simulation, and mission analysis to guide technology in end-to-end power and electric propulsion developments

Aerospace Communications

- End-to-end system analyses, modeling, simulation, and demonstrations
- Frequency spectrum utilization and signal propagation analyses
- Multi-gigabit processing communication payloads; Internet protocols (IP)-compliant aircraft and spacecraft; data distribution networks; satellite constellation networks; and autonomous terminals
- Space Internet protocols and technologies for space/terrestrial interoperability

Fluids and Combustion

- Understand and improve combustion processes
- Improve fire safety, fire prevention, detection and suppression
- Develop computational fluid dynamics tools for turbulent reacting flows
- Determine fluid and thermal physics of ice growth processes
- Determine effects of ice accretion on vehicle performance
- Develop icing tolerant designs and ice avoidance systems
- Develop fluid management and cryogenic fluids technologies

Science Core Competencies

Fluid Physics

Basic and applied research in fluid mechanics, heat and mass transport, and other physical principles governing this behavior and dynamics of fluid processes to provide:

- Scientific leadership for the Microgravity Fluid Physics Discipline, including ground-based and space-based research
- Basic understanding of fluid phase processes, from molecular to large-scale phenomena
- Knowledge to enable improved control and utilization of fluids in space-based systems (e.g., propellant management, life support, and thermal control systems)
- Exploitation of the knowledge-transfer potential for earth-based environmental and industrial processes

Combustion Science

Basic and applied research in combustion processes involved with rapid, self-sustaining chemical reactions that release significant amount of heat to provide:

- Scientific leadership for the Microgravity Combustion Science Discipline including ground-based and space-based research
- Basic understanding of combustion processes involving a wide combination of fuel, oxidizer, and ignition conditions
- Knowledge to improve fire safety practices/technologies for space-based systems (e.g., spacecraft fire safety flammability standards, detection systems, and suppression systems)
- Exploitation of the knowledge-transfer potential for earth-basedprocesses to improve fuel efficiency, reduce pollution, and control unwanted fires/explosions

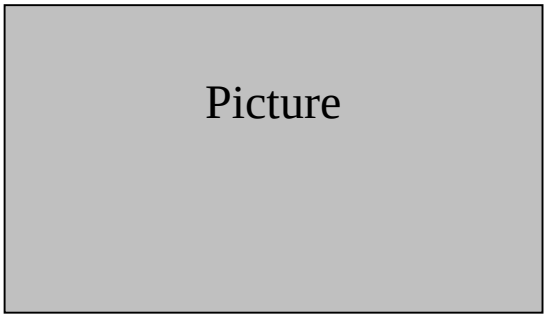
Bioscience and Engineering

Cutting-edge physical science and engineering knowledge to enable advances in the fields of biotechnology/biomedical research and applications, including:

- Stimulus to increase productive, cross-disciplinary, collaborative research involving the physical science/engineering and biological science communities
- Adaptation and application of research/knowledge/technology in fluids, sensors, instrumentation, and imaging of high value to biotechnology/biomedical researchers and practitioners

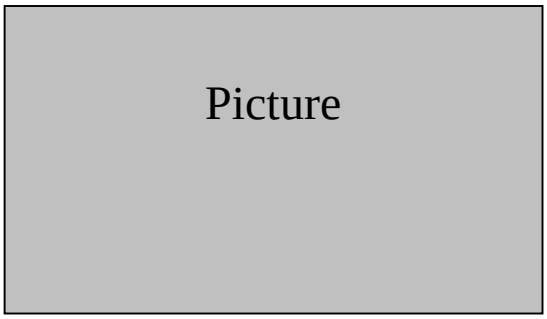
Agency-Specific Mission: Aeropropulsion

A major Glenn Research Center Agency-specific mission is to develop, verify, and transfer air-breathing propulsion technology for subsonic, supersonic, hypersonic, general aviation, and high-performance aircraft. Relative to this mission, GRC also conducts fundamental research in propulsion-related materials, structures, internal fluid mechanics, instrumentation, controls, and systems. Aeropropulsion encompasses turbine engines, intermittent-combustion engines (especially Stirling-cycle engines), electric engines, hybrid propulsion systems, combined cycle engines, ramjets, detonation wave engines and all other types of engines which are or have the potential to be used on aircraft and air-breathing space access vehicles.



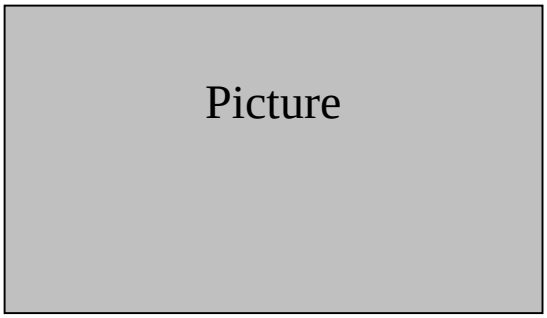
Agency-Specific Mission: Aerospace Power Systems Research and Technology

The NASA Administrator has designated GRC to have the Agency's lead role for the mission area of aerospace power systems research and technology. This role is crucial to future NASA missions and potential new initiatives. GRC aerospace power systems research and technology will benefit aeronautics and space in support of all NASA Enterprises. Responsibilities include the leadership and management of advanced power systems research and technology development and where appropriate, support of NASA's power system development.



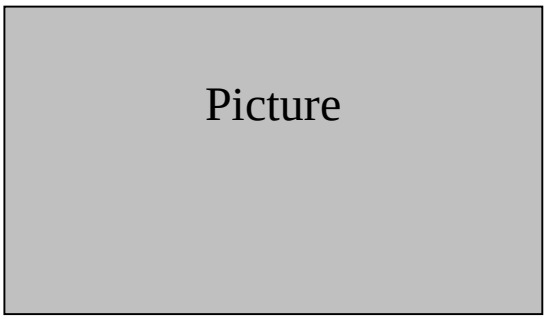
Center of Excellence: Turbomachinery

GRC has Agencywide responsibility for technologies directly applicable to fans, pumps, compressors, turbines, and other rotating components. Turbomachinery technologies are critical to air-breathing propulsion and power systems as well as to space and terrestrial propulsion and power conversion applications. Associated turbomachinery components include fans, cases, combustors, bearings, seals, gears, inlets, nozzles, sensors, and actuators. Disciplines critical to leadership in turbomachinery include materials, structures, lubrication, acoustics, aerodynamics, heat transfer, computational fluid dynamics, combustion, icing, instrumentation, and controls. GRC's primary objective in this area is to increase turbomachinery safety, durability, reliability, performance, efficiency, affordability, and environmental compatibility to improve U.S. industrial competitiveness and national security.



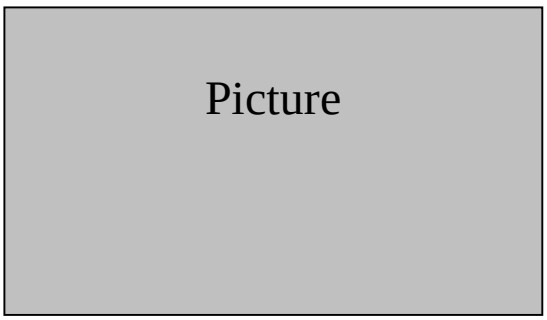
Program Responsibility: Aerospace Propulsion and Power Research and Technology

GRC has lead center management responsibility for NASA's Aerospace Propulsion and Power Research and Technology (R&T) Program in the Aerospace Technology Enterprise. This program focuses on maintaining U.S. superiority in engine development and ensuring the long-term environmental compatibility, safety, and efficiency of propulsion systems. The program addresses critical propulsion technology needs across a broad range of investment areas, including revolutionary advances in conventional aeropropulsion and unconventional propulsion technologies. This program develops technology that supports the goals and objectives other NASA Enterprises. In addition, the program supports and transfers applicable technologies to the Agency's programs, including Ultra-Efficient Engine Technology (UEET), Aviation Safety (AvSP), Advanced Space Transportation (ASTP), and Quiet Aircraft Technology (QAT).



Program Responsibility: Ultra-Efficient Engine Technology

GRC has lead center program management responsibility for the Ultra-Efficient Engine Technology (UEET) Program. The vision of the program is to develop and validate revolutionary propulsion technologies that will enable future generations of aerospace vehicles. Emerging technologies from the Aerospace Propulsion and Power R&T Program and other technologies will be incorporated in the UEET Program. The technologies developed and demonstrated will be applicable across the speed range from subsonic to hypersonic, with the emphasis on turbine-based systems. The UEET Program will lead to other focused programs, including engine system test demonstrators accomplished in partnership with other government agencies and industry. Technologies developed in the UEET Program will also likely be transferred to other programs, such as the Advanced Space Transportation and the Quiet Aircraft Technology.



GRC Support to NASA's Enterprises

	AST	HEDS	SS	ES	OBPR
Center of Excellence	**Turbomachinery**				
Lead Center Programs	• **Aerospace Propulsion and Power** • **Ultra Efficient Engine**				
Mission Areas	**Aeropropulsion**				
			Aerospace Power		
Supporting Center	• Aviation Safety – Accident mitigation – Weather-related accident prevention: aviation weather information/ advanced data link • Aviation System Capacity: advanced communications for air traffic mgmt. • Advanced Space Transportation Technology: Propulsion R&T, Turbine-Based Combined Cycle • Quiet Aircraft Technology • Computing Information Communication Technology: propulsion simulation, controls and instrumentation, intelligent systems control and operations, software integrity • Aerospace Flight Research R&T: ERAST • Aerospace Vehicle Systems R&T: system study and turbulence analysis • Airspace Operations Systems R&T: icing • Small Aircraft Transportation System • 2nd Gen RLV (SLI): Vehicle Systems, Propulsion, Systems Engineering	• International Space Station (ISS) - Electrical power - Communications enhancement • Communications and space internet technologies • Exploration initiatives - Power - In-space propulsion - Advanced space transportation propulsion concepts • Shuttle upgrades: materials, propulsion, and power	• Power • In-Space propulsion technologies • Communications and space internet technologies • New Millenium	• Power • In-space propulsion technologies • Communications and space internet technologies	• Microgravity research - Fluid physics - Combustion Science - Acceleration measurement - Bio-Science and Engineering • ISS Microgravity - Fluid and combustion research facility - Experiment payloads _ Multi-user hardware and support
Agency wide	• Spectrum Management • Small Business Technology Transfer and Research contracting • Small Business Innovation Research contracting	• Space Operations Management Office liaison for commercial communications • Environmental information systems		• Principal Center for: • Workgroup Hardware and Software • Aeronautics exhibits	

GRC Contributions to the Aerospace Technology Enterprise

To sustain global U.S. leadership in civil aeronautics and space transportation, the Aerospace Technology Enterprise (ASTE) has developed the following goals and objectives that GRC supports.

ASTE Goal 1: Revolutionize Aviation- Enable the safe, environmentally-friendly expansion of aviation.

ASTE Objective 1: Increase Safety- Make a safe air transportation system even safer.

ASTE Performance Goal 2R1: Complete the interim progress assessment utilizing the technology products of the Aviation Safety program as well as the Aerospace Base R&T efforts and transfer to industry an icing CD-ROM, conduct at least one demonstration of an aviation safety related subsystem, and develop at least two-thirds of the planned models and simulations.

GRC Objective A1.0: Reduce aircraft accidents related to icing, weather, poor visibility, and engine problems; develop technology to prevent and suppress aircraft fires.

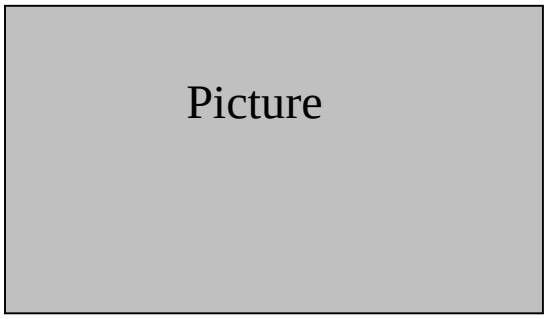
GRC Milestones supporting these Goals and Objectives:

A1.1: National Aviation Weather Information Network (AWIN) *
Demonstrate AWIN digital data link capability for graphical display of weather information. [4Q; 2500/S.Nadell]

A1.2: CD-ROM icing training module for pilots*
Provide information on in-flight icing hazards to pilots on a CD-ROM suitable for home use and individual training. The desired outcome of this milestone is to reduce in-flight icing incidents and accidents. [3Q; 0140/G.Seng, 2500/M.Wadel]

A1.3: LEWICE Version 2.2
Release an updated and validated computational 2D ice accretion prediction code, which incorporates thermal subroutines for modeling hot and electro-thermal anti/de-icing systems. [3Q; 0140/G.Seng, 2500/M.Wadel]

A1.4: UltraSafe Propulsion Technologies
Transfer UltraSafe Propulsion Technologies to the Aviation Safety Program, including validated structural concepts which could be further developed into safety-certified, lighter-weight, lower-cost, and more robust engine fragment containment systems. [4Q; 0140/G.Seng, 2200/S.Johnson]



ASTE Objective 2: Reduce Emissions- Protect local air quality and our global climate.

ASTE Performance Goal 2R2: NASA's research stresses engine technology to reduce the emissions of oxides of nitrogen (NOx) and carbon dioxide (CO2). The annual performance goal is to complete sector testing of a low-NOx combustor concept capable of a 70% reduction in NOx from the 1996 [International Civil Aviation Organization (ICAO)] baseline, and demonstrate at least one additional concept for the reduction of other emissions.

GRC Objective A2.0: Reduce nitrogen oxide (NOx) emissions of future aircraft by 70 percent in ten years and by 80 percent within 25 years (using the 1996 ICAO standard for NOx as the baseline). Reduce CO2 emissions of future aircraft by 25 percent and 50 percent in the same timeframe (using 1997 subsonic aircraft technology as the baseline).

GRC Milestones supporting these Goals and Objectives:

A2.1: Aspirating Seal Demonstration*
Demonstrate engine aspirating seal technology in partnership with industry. [2Q; 2100/R.J. Shaw; 2300/M.J. Long-Davis]

A2.2: Controls Architecture Payoff Studies*
Complete benefits studies of intelligent propulsion controls for small-thrust class engines (less than 20,000 pounds thrust). [3Q; 2100/R.J. Shaw, 2200/D. Sokolowski]

A2.3: Integrated Component Technology Demonstration Plan for Small-Thrust Class Engines*
Develop an Integrated Component Technology Demonstration Plan for collaborative tests of engine demonstrators incorporating UEET technologies for small-thrust class engines (less than 20,000 pounds thrust). [3Q; 2100/R.J. Shaw, 2300/M.J. Long-Davis]

A2.4: Integrated Component Technology Demonstration Plan for Access-to-Space Engines*
Develop an Integrated Component Technology Demonstration Plan for collaborative tests of engine demonstrators incorporating UEET technologies for access-to-space engines. [3Q; 2100/R.J. Shaw, 2300/M.J. Long-Davis]

A2.5: Initial Low NOx Reduction Demonstration in a Combustor Sector for Subsonic Engines*
In combustor sector tests, demonstrate a 65% reduction in the production of Nitrogen Oxides (NOx), relative to the 1996 International Civil Aviation (ICAO) standards for landing/take-off conditions in a simulated subsonic engine. [4Q; 2100/R.J. Shaw, 2200/J. Rohde]

A2.6: Ceramic Thermal Barrier Coating System*
Select a low conductive Ceramic Thermal Barrier Coating to achieve a significant increase in temperature capability. [4Q; 2100/R.J. Shaw, 2300/A. Misra]

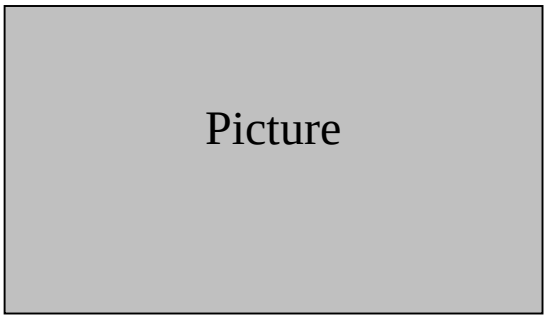
A2.7: MEMS Engine Emissions Sensors
Demonstrate Microelectromechanical System (MEMS) high-temperature emission sensors in an engine. [4Q; 5500/M.Zeller and 5510/G.Hunter]

A2.8: Hybrid Fuel Cell and Liquid Hydrogen Fueled Optimized Turbofan Concepts
Investigate systems optimized to fully exploit the beneficial physical properties of liquid hydrogen as a fuel. [4Q; 0140/G.Seng, 2200/D.Ercegovic]

A2.9: Emission Flame Tube Tests
Demonstrate revolutionary concepts for reducing gaseous, particulate and aerosol emissions in a flame tube test. The desired outcome is to develop actively-controlled, durable and smart low-emission fuel injection systems, which will enable aircraft engines to operate more efficiently, be environmentally friendly, reduce operating costs, and increase operating safety margins. [4Q; 0140/G.Seng, 2200/R.Corrigan]

A2.10: Identify revolutionary aeropropulsion concepts and assess preliminary performance.
Update the portfolio of enabling technologies for extremely high-payoff future propulsion systems, prioritized by quantified benefits. [4Q; 0140/G.Seng, 2200/D.Ercegovic]

A2.11: PMC Inlet Guide Vane Test
Conduct an engine test of a coated polymer matrix composite inlet guide vane, with the objective of improving inlet guide vane durability and operating life. [4Q; 140/G.Seng, 2200/C.Ginty]



ASTE Objective 3: Reduce Noise- Reduce aircraft noise to benefit airport neighbors, the aviation industry, and travelers.

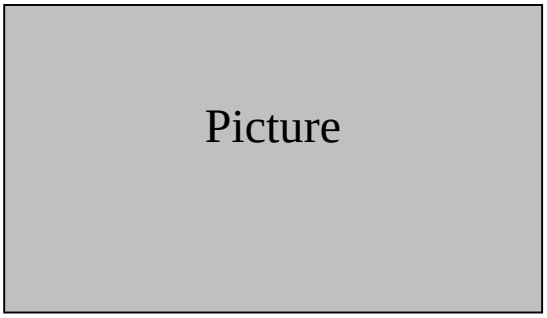
ASTE Performance Goal 2R3: NASA's research stresses reducing noise in the areas of engines, nacelles, engine-airframe integration, aircraft interiors and flight procedures. The annual performance goal is to assess and establish the strongest candidate technologies to meet the 10-decible reduction in community noise.

GRC Objective A3.0: Reduce the perceived noise of future subsonic aircraft engines, which are based on pre-1997 engine designs, by a factor of 2 by the year 2007 and by a factor of 4 by the year 2022.

GRC Milestones supporting these Goals and Objectives:

A3.1: Fan Noise Tests and Code Development
Conduct fan tests in the 9x15 wind tunnel to determine rotor contributions to total fan noise for two fans with different loading distributions and develop advanced measurement methods to support Computational Aeroacoutics code development. [4Q; 2300/J. Grady]

A3.2: Jet Noise Reduction Concept Assessment
Complete an evaluation of the noise reduction benefits of chevron nozzles and nozzle lip treatment concepts using the Small Host Jet Acoustic Rig. [4Q; 2300/J. Grady]



ASTE Objective 4: Increase Capacity- Enable the movement of more air passengers with fewer delays.

ASTE Performance Goal 2R4: NASA's research stresses operations systems for safe, efficient air traffic management and new aircraft configurations for high productivity utilization of existing runways. The annual performance goal is to develop at least two decision support tools for arrival, surface, and departure operations, and define requirements for future aviation system concepts.

GRC Objective A4.0: Develop and demonstrate enhanced aviation system throughput by an improved airspace communications infrastructure to support free-flight air traffic management concepts.

GRC Milestones supporting these Goals and Objectives:
[None for FY2002]

ASTE Objective 5: Increase Mobility- Enable people to travel faster and farther, anywhere, anytime.

ASTE Performance Goal 2R5: NASA's research stresses aircraft technologies which enable the use of existing small community and neighborhood airports, without requiring control towers, radar installations, and more land use for added runway protection zones. The annual performance goal is to baseline a partnership with the FAA and system engineering documents for the Small Aircraft Transportation System concept.

GRC Objective A5.0: Develop low-cost intermittent-combustion and turbine engines and single-lever engine controls for general aviation aircraft.

GRC Milestones supporting these Goals and Objectives:
[None for FY2002]

ASTE Goal 2: Advance Space Transportation- Create a safe, affordable highway though the air and into space.

ASTE Objective 6: Mission Safety- Radically improve the safety and reliability of space launch systems.

ASTE Performance Goal 2R6: Complete risk reduction and architecture reviews to support design and demonstration decisions.

GRC Objective A6.0: Improve the safety and reliability of access-to-space propulsion systems by developing new materials and health monitoring techniques to improve their life and operability.

GRC Milestones supporting these Goals and Objectives:

A6.1: Cooled Panel Testing
Hot-fire test 2.5 inch by 10 inch water-cooled ceramic matrix composite panels in RCL Cell 22. [3Q; 6500/M.Klem]

A6.2: NITEX Software Demonstration
Port the NITEX diagnostic technologies and IVHM architecture to flight-like hardware and test them against nominal and off-nominal Main Propulsion System data sets. [4Q; 6500/M.Klem]

A6.3: Life Prediction Techniques for Metal Matrix Composites
Release an enhanced version of MAC/GMG software (Version 4.0), incorporating both deformation and damage models and a new high-fidelity micromechanics formulation. [4Q; 6500/M.Klem]

ASTE Objective 7: Mission affordability- Create an affordable highway to space.

ASTE Performance Goal 2R7: Complete risk reduction and architecture reviews and initial hardware demonstrations to support design and demonstration decisions.

GRC Objective A7.0:
Reduce the cost contribution of access-to-space propulsion systems and subsystems while improving their performance, life, function and operability.

GRC Milestones supporting these Goals and Objectives:

A7.1: Power and Actuator Technology Risk Reduction
Complete power and actuator requirements definition for 2nd Gen. Risk Reduction Base Period. [4Q; 6500/N.Pham]

A7.2: PEM Fuel Cell Powerplant
Award the Proton-Exchange Membrane Fuel Cell Powerplant Phase I Development contract. [2Q; 6500/N.Pham]

A7.3: Hypersonics Program Non-Advocate Review
Complete RTA/RBCC cycle selection, conduct a Preliminary Requirements Review, and prepare and present a NAR package for the RTA/RBCC project. [6500]

A7.4: Advanced Control System Seals
Complete installation of the hot-seal compression text fixture. [4Q; 6500/P.Dasgupta]

A7.5: PDE Concept
Complete assessment and conceptual design of Pulse-Detonation Engine-based hybrid cycle and combined cycle propulsion systems. [3Q; 0140/G.Seng, 0142/H.Perkins]

A7.6: PDE Performance Assessment*
Complete a quantitative assessment of PDE performance levels and target PDE component research to critical system performance issues. [4Q; 0140/G.Seng, 0142/H.Perkins]

ASTE Objective 8: Mission Reach- Extend our reach in space with faster travel times.

ASTE Performance Goal 2R8: Conduct at least one electric propulsion test.

GRC Objective A8.0: Enable faster travel times by developing propulsion systems that are lighter, more efficient, and capable of providing thrust for long duration.

GRC Milestones supporting these Goals and Objectives:
A8.1: 50kW Hall Thruster*
Conduct initial testing of the first U.S. prototype 50 kW Hall Thruster. [6500]

ASTE Goal 3: Pioneer Technology Innovation- Enable a revolution in aerospace systems.

ASTE Objective 9:
Engineering Innovation- Enable rapid, high-confidence and cost-efficient design of revolutionary systems.

ASTE Performance Goal 2R9:
Conduct at least five demonstrations of revolutionary aerospace subsystems, including

- **9A-** Develop prototype environments that are distributed across heterogeneous platforms, are dynamically extensible, and which support collaborative visualization, analysis and computational steering.
- **9B-** Demonstrate improvement in time-to-solution for aerospace applications through high-end computing and end-to-end networking capabilities.

GRC Objective 9.0: Develop computing and testing tools to reduce aircraft engine design and development time.

GRC Milestones supporting these Goals and Objectives:

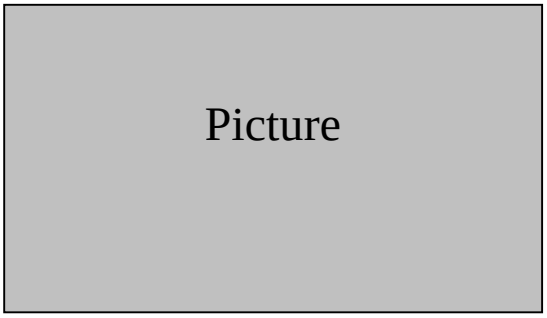
A9.1: Release Numerical Propulsion System Simulation (NPSS) Version 2
The NPSS Version 2 will enhance collaborative visualization, space transportation components and increase unidimensional fidelity. [2Q; 2900/C.Naiman]

A9.2: Multidisciplinary Turbopump Simulation
Demonstrate multidisciplinary unsteady fluid/structural coupling in a centrifugal turbopump for eventual application in rocket-based and turbine-based combined-cycle propulsion systems. Validation of the simulation will be performed using an RL10a30 turbopump. [4Q; 2900/K.Owen]

A9.3: High Fidelity Turbofan Flowpath Simulation
Demonstrate full primary flowpath simulation of a two-spool turbofan engine in less than 15 hours of CPU time. This Navier-Stokes simulation will be run to numerical convergence, including torque balance. The turbomachinery simulation will use the APNASA flow code and the combustor simulation will use the National Combustion Code. Validation of the simulation will be performed using a GE 90 engine. [3Q; 2900/J.Veres]

A9.4: Multidisciplinary RLV Forebody/Inlet Simulation
Demonstrate high-fidelity fluid/thermal/structural simulation of an RLV forebody and inlet

A9.5: Alloy Design Workbench
Demonstrate a new software tool that can run on a PC to design alloys for specific engineering requirements with a high degree of confidence using only bulk properties, thereby significantly reducing development time. [4Q; 0140/G.Seng, 2200/C.Ginty]



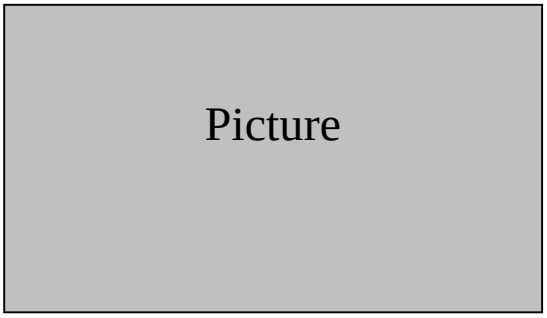
ASTE Objective 10:
Technology Innovation- Enable fundamentally new aerospace system capabilities and missions

ASTE Performance Goal 2R10: Develop at least two new materials concepts and demonstrate the feasibility of at least two nanotechnology concepts and two other concepts, including:

- **10A-** Demonstrate aligned carbon nanotubes for polymer matrix material
- **10B-** Demonstrate oscillatory flow control actuators
- **10C-** Demonstrate space communication link technology operating at 622 megabits per second for Direct Data Distribution users.

GRC Objective A10.0:
[Same]

GRC Milestones supporting these Goals and Objectives:
A10.1: Demonstrate Ferroelectric Reflectarray
Demonstrate proof-of-concept for a Ka-band Ferroelectric Reflectarray. [4Q; 6100/P.Vrotsos, 6160/M.Jarrell]



ASTE Goal 4: Commercialize Technology- Extend the commercial application of NASA technology for economic benefit and improved quality of life

ASTE Objective 11:
Commercialization- Facilitate the greatest practical utilization of NASA know-how and physical assets by U.S. industry

ASTE Performance Goal 2R11: Continue the solicitation of customer feedback on the services, facilities and expertise provided by the Aerospace Technology enterprise, including:

- **11A-** Achieving a facility utilization customer satisfaction rating of 95 % at "5" or better using a "10"point scale, and 80% at "8" or better, based on exit interviews.
- **11B-** Transferring at least 12 new technologies and processes to industry and other government agencies

GRC Objective A11.0:
[Same]

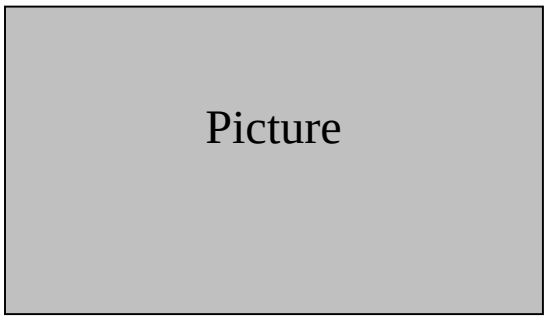
GRC Milestones supporting these Goals and Objectives:
A11.1: LIFT Tenants
Increase the number of tenants in the Lewis Incubator for Technology (LIFT) to 14, of which at least 50% will be minority or women-owned. [4Q; 9400/L.Viterna]

A11.2: Commercial Technology Fund
Demonstrate application of engineering and technology insertion into at least five different company's products through the Commercial Technology Fund. [4Q; 9400/LViterna]

A11.3: GRC Biomedical Technology Applications
Collaborate with at least four separate partners within the Great Lakes region on biomedical applications of GRC technology. [4Q; 9400/J. Viterna]

A11.4: Focused Marketing Plans
Establish and implement at least two focused marketing plans for GRC technologies with high commercialization potential. [4Q; 9400/L.Viterna]

A11.5: MEMS Technology Transfer
Transfer harsh-environment MEMS technologies to Garrett-Morgan Commercialization Initiative partners for product development. [4Q; 5500/M.Zeller and 5510/L.Matus]



ASTE Performance Goal 2R12: Continue the implementation of current education outreach activities and establish new plans for all new program activities initiated in FY2002.

GRC Objective A12.0: Implement ASTE education outreach plans, particularly for the Aerospace Propulsion and Power and Ultra-Efficient Engine Technology programs, using the Glenn Aerospace Education Coordinating Committee and other outreach organizations and processes.

GRC Milestones supporting these Goals and Objectives:
[See Milestone C4.10.]

ASTE Goal 5: Space Transportation Management- Provide commercial industry with the opportunity to meet NASA's future launch needs, including human access to space, with new launch vehicles that promise to radically reduce cost and improve safety and reliability

ASTE Objective 13: Utilize NASA's Space Transportation Council (STC) in combination with an External Independent Review Team (EIRT) to assure agency-level integration of near and far-term space transportation investments.

GRC Objective A13.0:
[Same]

GRC Contributions to the Human Exploration and Development of Space Enterprise

The mission of the Human Exploration and Development of Space (HEDS) Enterprise is to bring the frontier of space fully within the sphere of human activity to build a better future for all humans. GRC supports the HEDS Enterprise by providing expertise in several areas: research, development, operations planning, and technology demonstration for the International Space Station (ISS); power system technology development for Space Shuttle upgrades; and research in space power, onboard propulsion, space communications, and space transportation.

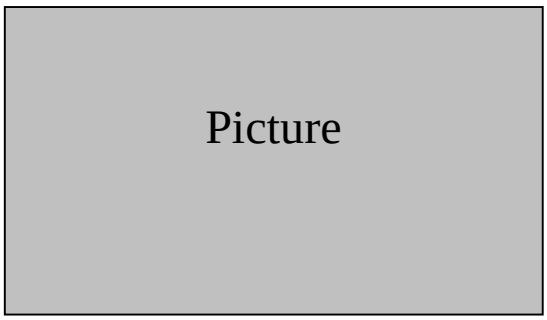
HEDS Goal 1— Expand the space frontier.

HEDS Objectives:

- **1A-** Invest in the development of high-leverage technologies to enable safe, effective and affordable human/robotic exploration
- **1B-** Conduct engineering research on the International Space Station to enable exploration beyond Earth orbit.
- **1C-** Enable human exploration through collaborative robotic missions.
- **1D-** Define innovative human exploration mission approaches.
- **1E-** Develop exploration/commercial capabilities through private sector and international partnerships.

GRC Objective H1.0: Develop power, communications, and in-space propulsion systems and advance the state of knowledge of reduced-gravity effects to enable human and robotic missions of exploration.

GRC Milestones supporting this Goal and these Objectives:
H1.1: LANTR Test Rig
Contingent on funding, design a multi-zone injection test rig. [4Q; 6500/S.Borowski]



HEDS Goal 2: Enable Humans to Live and Work Permanently in Space

HEDS Objectives:

- **2A-** Provide and make use of safe, affordable and improved access to space.
- **2B-** Operate the International Space Station to advance science, exploration, engineering and commerce.
- **2C-** Ensure the health, safety and performance of humans living and working in space.
- **2D-** Meet sustained space operations needs while reducing costs

-

GRC Objective H2.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]

HEDS Goal 3: Enable the Commercial Development of Space.

HEDS Objectives:

- **3A-** Improve the accessibility of space to meet the needs of commercial research and development.
- **3B-** Foster commercial endeavors with the International Space Station and other assets.
- **3C-** Develop new capabilities for human space flight and commercial applications through partnerships with the private sector.

GRC Objective H3.0: Enable the commercialization of space communication, power, in-space propulsion, and other aerospace technologies.

GRC Milestones supporting this Goal and these Objectives:

H3.1: International Telecommunications Union Delegation
Develop, present and lead the NASA/US technical constituents in International Telecommunications Union (ITU) Working Parties 7B and 7C. [2Q; 6100/P.Vrotsos, 6140/W.Whyte]

H3.2: CPM Text for World Radiocommunications Conference
Lead the U.S. Working Party 7E in completing the Conference Preparatory Text for the World Radiocommunications Conference WRC-2003. [3Q; 6100/P.Vrotsos, 6140/W.Whyte]

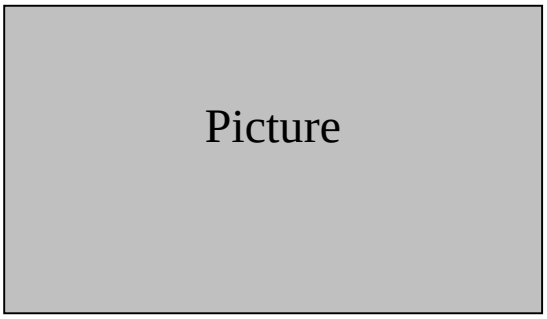
H3.3: Finalize World Radiocommunications Conferences WRC-2003 Proposals
Complete U.S. proposals of interest to NASA for the World Radiocommunications Conference WRC-2003. [4Q; 6100/P. Vrotsos, 6140/W.Whyte]

H3.4: Support Space Frequency Meeting
Develop and present NASA/U.S. positions to the Space Frequency Coordination Group meeting. [4Q; 6100/P.Vrotsos, 6140/W. Whyte]

H3.5: Demonstrate Space Internet Testbed
Demonstrate space Internet testbed capability to verify NASA's use of commercial protocols and network technologies. [3Q; 6100/P.Vrotsos, 6160/P.Paulsen]

H3.6: Characterize a Phased-Array Antenna System
Characterize the performance of an electrically-steered phased-array antenna with high-rate modulated data. [4Q; 6100/P.Vrotsos, 6160/R.Reinhart]

H3.7: Develop a Silicon Germanium-based Power Amplifier
Contingent on execution of a Space Act Agreement with Boeing, develop a Ku-band Silicon-Germanium-based power amplifier MMIC design for a phased-array antenna transmit module. [4Q; 6100/P.Vrotsos, 6160/W.Whyte]



HEDS Goal 4: Share the Experience and Benefits of Discovery

HEDS Objectives:

- **4A-** Engage and involve the public in the excitement and the benefits of- and in setting the goals for- the exploration and development of space.
- **4B-** Provide significantly more value to significantly more people through exploration and space development efforts.
- **4C-** Advance the scientific, technological and academic achievement of the Nation by sharing our knowledge, capabilities and assets

GRC Objective H4.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]

GRC Contributions to the Space Science Enterprise

The mission of the Space Science Enterprise (SSE) is to explore the solar system; chart the evolution of the universe and understand its galaxies, stars, planets, and life; discover planets around other stars; and search for life beyond Earth. The Glenn Research Center supports this enterprise mission by providing advanced power, in-space propulsion, and space communication technologies—all of which will lower mission costs and enable new capabilities. In addition, GRC plays a major role in the crosscutting technology program that supports all the space Enterprises and makes specific contributions to Space Science mission-focused efforts.

SSE Goal 1: Science- Chart the evolution of the universe from origins to destiny, and understand its galaxies, stars and life.

SSE Objectives:

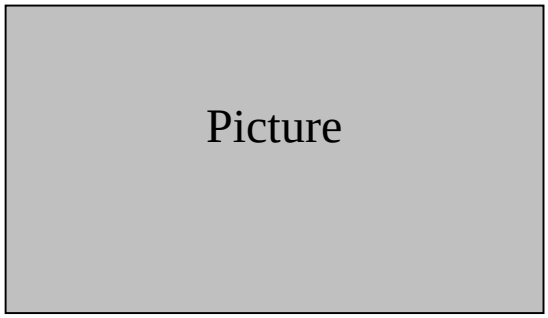
- **1A-** Understand the structure of the Universe, from its earliest beginnings to its ultimate fate.
- **1B-** Explore the ultimate limits of gravity and energy in the Universe.
- **1C-** Learn how galaxies, stars and planets form, interact and evolve.
- **1D-** Look for signs of life in other planetary systems.
- **1E-** Understand the formation and evolution of the Solar System and the Earth within it.
- **1F-** Probe the evolution of life on Earth, and determine if life exists elsewhere in our Solar System.
- **1G-** Understand our changing Sun and its effects throughout the Solar System.
- **1H-** Chart our destiny in the Solar System.
- **1I-** Support the Strategic Plan Science Objectives; Development/Near-Term Future Investments

GRC Objective S1.0: Develop in-space propulsion, power, communication and other advanced spacecraft technologies for application to Space Science research.

GRC Milestones supporting this Goal and these Objectives:
S1.1: Next-Generation Ion Propulsion System
Submit a proposal in response to an upcoming NASA Research Announcement for a Next-Generation Ion Propulsion System. [2Q; 6500/W.Taylor and 6900/S.Benson]

S1.2: Cryogenic Propellant Storage
Contingent on funding, advance the state-of-the-art for long-term, low-loss cryogenic propellant storage by performing an advanced zero-boiloff demonstration. [4Q; 6500/D.Vento]

S1.3: Core and Emerging Technology
Submit proposals in response to an upcoming NASA Research Announcement for Core and Emerging Technology Investment. [3Q; 6500/W.Taylor]



SSE Goal 2: Technology/Long-Term Future Investments- Develop new technologies to enable innovative and less expensive research and flight missions.

SSE Objectives:

- **2A-** Acquire new technical approaches and capabilities.
- **2B-** Validate new technologies in space.
- **2C-** Apply and transfer technology.

GRC Objective S2.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]

SSE Goal 3: Education and Public Outreach- Share the excitement and knowledge generated by scientific discovery and improve science education.

SSE Objectives:

- **3A-** Share the excitement of space science discoveries with the public.
- **3B-** Enhance the quality of science, mathematics and technology education, particularly at the pre-college level.
- **3C-** Help create our 21st century scientific and technical workforce.

GRC Objective S3.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]

GRC Contributions to the Earth Science Enterprise

The Earth Science Enterprise (ESE) mission is to develop a scientific understanding of the Earth system and its response to natural and human-induced changes to improve prediction of climate, weather and natural hazards for present and future generations. Advanced spacecraft technology being developed by GRC provides capabilities that will significantly enhance current or enable new Earth Science missions. GRC's contributions are in advanced power, in-space propulsion, and space communications technology. The majority of the GRC crosscutting technology efforts (conducted under the auspices of the Space Science Enterprise) are applicable to Earth Science missions. In addition, GRC is developing technology to meet specific Earth Science mission requirements.

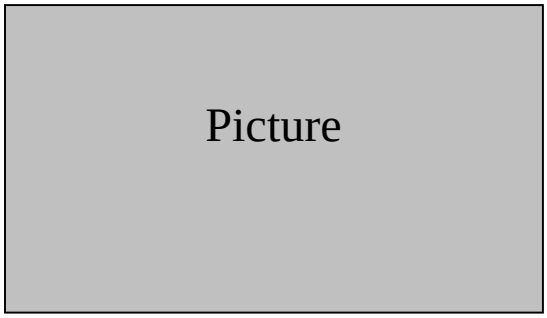
ESE Goal 1: Observe, understand and model the Earth system to learn how it is changing, and the consequences for life on Earth.

ESE Objectives:

- **1A**- Discern and describe how the Earth is changing.
- **1B**- Identify and measure the primary causes of change in the Earth system.
- **1C-** Determine how the Earth system responds to natural and human-induced changes.
- **1D-** Identify the consequences of change in the Earth system for human civilization.
- **1E-** Enable the prediction of future changes in the Earth system.

GRC Objective E1.0: Develop power, in-space propulsion, communication, and other advanced spacecraft technologies for application to Earth-science related research.

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]



ESE Goal 2: Expand and accelerate the realization of economic and societal benefits from Earth science, information and technology.

ESE Objectives:

- **2A-** Demonstrate scientific and technical capabilities to enable the development of practical tools for public and private-sector decision makers
- **2B-** Stimulate public interest in and understanding of Earth system science and encourage young scholars to consider careers in science and technology.

GRC Objective E2.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]

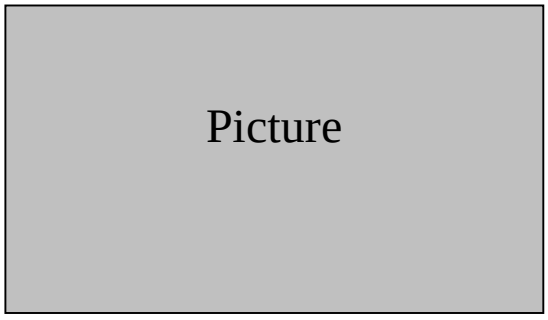
ESE Goal 3: Develop and adopt advanced technologies to enable mission success and serve national priorities

ESE Objectives:

- **3A-** Develop advanced technologies to reduce the cost and expand the capability for scientific Earth observation.
- **3B-** Develop advanced information technologies for processing, archiving, accessing, visualizing, and communicating Earth science data.
- **3C-** Partner with other agencies to develop and implement better methods for using remotely-sensed observations in Earth system monitoring and prediction.

GRC Objective E3.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]



GRC Contributions to the Biological and Physical Research Enterprise

The Biological and Physical Research Enterprise (BPR) conducts interdisciplinary fundamental and applied research to pursue answers to the basic questions underlying human space flight:

- How can human existence expand beyond the home planet to achieve maximum benefits from space?
- How do fundamental laws of nature share the evolution of life?

GRC supports BPR by developing and transferring basic knowledge and technologies related to fluid physics, combustion sciences, acceleration measurement, and bio-science and engineering.

BPR Goal 1: Conduct research to enable safe and productive human habitation of space.

BPR Objectives:

- **1A-** Conduct research to ensure the health, safety and performance of humans living and working in space.
- **1B-** Conduct research on biological and physical processes to enable future missions of exploration.

GRC Objective B1.0: Facilitate and enable the conduct of research to improve spacecraft fire and safety and to improve countermeasures for long-term exposure to the microgravity environment of space.

GRC Milestones supporting this Goal and these Objectives:
B1.1: Interdisciplinary Fluid Physics-Biotechnology/Biomedicine
Publish a white paper describing the benefits of interdisciplinary fluid physics-biotechnology/biomedical research. [1Q; 6700/F.Kohl]

BPR Goal 2: Use the space environment as a laboratory to test the fundamental principles of physics, chemistry and biology.

BPR Objectives:

- **2A-** Investigate chemical, biological, and physical processes in the space environment, in partnership with the scientific community.
- **2B-** Develop strategies to maximize scientific research output on the International Space Station and other space research platforms.

GRC Objective B2.0: For the combustion science and fluid physics disciplines, enable the research community to use gravity as an experimental variable.

GRC Milestones supporting this Goal and these Objectives:
B2.1: Physics of Colloids in Space Experiment
Successfully complete the Physics of Colloids in Space experiment on the International Space Station. (ISS). [3Q; 6700/F.Kohl]

B2.2: Coarsening in Solid-Liquid Mixtures 2 Experiment
Provide for the deployment of the Coarsening in Solid-Liquid Mixtures-2 experiment, integrate it in the ISS Microgravity Science Glovebox and initiate experiment operations. [4Q; 6700/F. Kohl]

B2.3: InSPACE Experiment
Provide for the deployment of the Investigating the Structures of Paramagnetic Aggregates from Colloid Emulsions (In SPACE) experiment, integrate it in the ISS Microgravity Science Glovebox, and initiate experiment operations. [3Q; 6700/K.Schubert]

B2.4: Critical Viscosity of Xenon 2 Experiment
Successfully complete the Critical Viscosity of Xenon 2 experiment on STS-107. [3Q; 6700/F.Kohl]

B2.5: Microgravity Combustion Smoldering Experiment
Successfully complete the Microgravity Combustion Smoldering experiment on STS-108. [1Q; 6700/T.Sutliff)

B2.6: Combustion Module 2 Experiments
Successfully complete the Laminar Soot Processes, Structure of Flame Balls at Low Lewis Numbers, and MIST experiments on STS-107 using the Combustion Module 2 facility. [3Q; 6700/T.Sutliff]

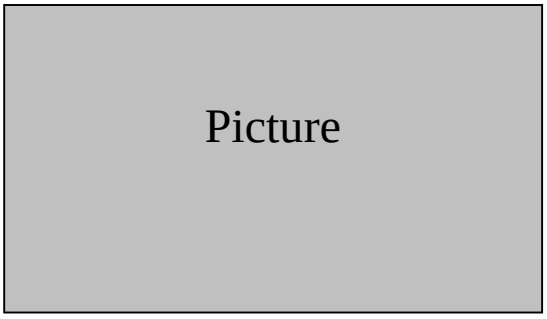
B2.7: Collisions in Dust Experiment 2
Successfully complete the Collisions in Dust Experiment 2 on STS-108. [6700/F. Kohl]

B2.8: Microgravity Acceleration Environment
Measure and report the acceleration environment during microgravity experiment operations on STS-107. [3Q; D. Francisco]

B2.9: ISS Acceleration Environment
Measure the ISS acceleration environment and publish Increment Reports for ISS increments 3 and 4. [4Q; 6727/D. Francisco]

B2.10: ISS Acceleration Environment Neural Network
Complete implementation of a neural network/fuzzy logic system to assess and monitor the ISS acceleration environment. [2Q; 6727/D.Francisco]

B2.11: ISS Fluids and Combustion Facility
Complete the Critical Design Review of the Fluids Integrated Rack [3Q; 6700/R.Zurawski]



BPR Goal 3: Enable and promote commercial research in space

BPR Objectives:

- **3A-** Provide technical support for companies to begin space research.
- **3B-** Foster commercial research endeavors with the International Space Station and other assets.
- **3C-** Systematically provide basic research knowledge to industry.

GRC Objective B3.0:
[Same]

GRC Milestones supporting this Goal and these Objectives:
[None for FY2002]

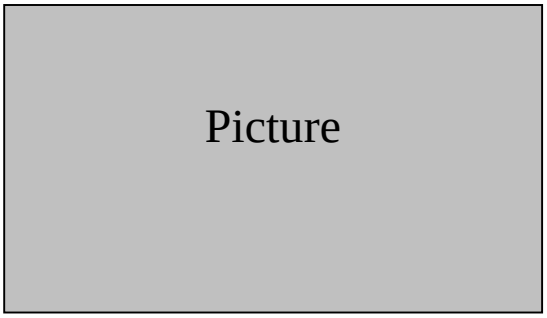
BPR Goal 4: Use space research opportunities to improve academic achievement and the quality of life

BPR Objectives:

- **4A-** Advance the scientific, technological and academic achievement of the Nation by sharing our knowledge, capabilities and assets.
- **4B-** Engage and involve the public in research in space.

GRC Objective B4.0: Provide information and educational materials, programs and training about BPR-related subjects to U.S. teachers.

GRC Milestones Supporting this Goal and these Objectives:
B4.1: Microgravity Education Outreach
Expand the Dropping in Microgravity Environment (DIME) high school competition to the local six-state region (Indiana, Illinois, Michigan, Wisconsin and Minnesota as well as Ohio). [3Q; 6727/R.DeLombard]



GRC Crosscutting Process Objectives

The NASA Strategic Plan outlines the following crosscutting processes:

- Manage strategically
- Provide aerospace products and capabilities
- Generate knowledge
- Communicate knowledge

This section identifies specific GRC implementing activities related to these crosscutting processes. These activities are enabling functions that support GRC's mission.

Manage Strategically (MS)

MS Goal 1: Enable the Agency to carry out its responsibilities effectively, efficiently, and safely through sound management decisions and practices

MS Objective 1: Protect the safety of our people and facilities and the health of our workforce.

MS Performance Goal 2MS1: NASA will increase the safety of its infrastructure and the health of its workforce through facilities safety improvements, reduced environmental hazards, increased physical security, and enhanced safety and health awareness, and appropriate tools and procedures for health enhancement.

GRC Objective M1.0: Implement a comprehensive program of institutional safety initiatives and risk assessments identifying hazards associated with GRC's research facilities and workplace and implement mitigation initiatives for those hazards that measurably improve the safety of GRC's infrastructure and workforce**.**

GRC Milestones supporting these Goals and Objectives:
M1.1: Support the NASA Agency goal to reduce the overall occurrence of injuries (due to occupational injury or illness) by 3% per year from the FY1997 baseline, to 1.15 occurrences per 100 workers (0.98). [4Q; 0500/S.Hardy]

MS Objective 2: Achieve the most productive application of Federal acquisition policies.

MS Performance Goal 2MS2: Continue to take advantage of opportunities for improved contract management by maintaining a high proportion of performance-based contracts.

GRC Objective M2.0: Maximize the percentage of GRC contract dollars directed to performance-based contracts and to small, disadvantaged and women-owned small businesses.

GRC Milestones supporting these Goals and Objectives:
M2.1: Performance-Based Contracting
Obligate at least 80 percent of all procurement dollars to performance-based contracts. [4Q; 0200/R.Fails]

MS Performance Goal 2MS9: Continue integrating small, small disadvantaged, and women-owned business together with minority universities into the competitive base from which NASA can purchase goods and services.

M2.2: Socioeconomic Procurement Goals
Achieve the small, disadvantaged and women-owned business goals assigned to the Center and improve the FY2001 percentage and contract dollars obligated to Hub Zone firms, Historically Black Colleges and Universities, Other Minority Educational Institutions, and service-disabled veterans. [4Q; 0600/B.Baker]

MS Objective 3: Manage our fiscal and physical resources optimally.

MS Performance Goal 2MS3: Revitalize Agency facilities and reduce environmental liability.

GRC Objective M3.0: Effectively and economically manage GRC's financial and resources. This includes implementing the Agency's Integrated Financial Management System, maintaining an ISO 9000-certified Business Management System, taking steps to have a workforce representative of America's diversity, and reducing Equal Employment Opportunity complaints through use of the Informal Alternative Dispute Resolution Process.

GRC Milestones supporting these Goals and Objectives:
M3.1: Costing
Cost at least 75 percent of the resources authority available to cost during the fiscal year. [4Q; 0200/R.Fails]

M3.2: Obtain Nuclear Regulatory Commission approval of the Plum Brook Nuclear Reactor Facility Decommissioning Plan. [4Q; 0500/S.Hardy]

M3.3: Maintain an ISO-14001 registered Environmental Management System. [4Q; 0500/S.Hardy]

MS Objective 4: Enhance the security, efficiency, and support provided by our information technology resources.

MS Performance Goal 2MS4: Improve IT infrastructure service delivery by providing increased capability and efficiency which maintaining a customer rating of satisfactory.

MS Performance Goal 2MS5: Enhance IT security by meeting established performance indicators in three critical areas-vulnerabilities detected, Training, and IT Security Plans.

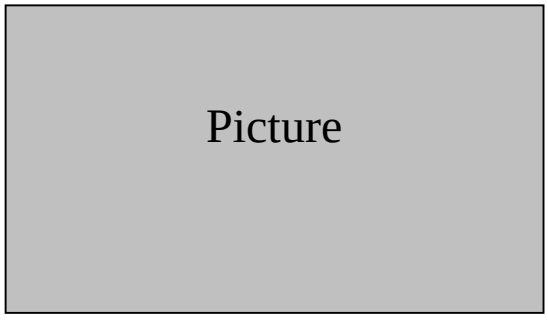
MS Performance Goal 2MS6: Enhance mission success through seamless, community-focused electronic service delivery.

GRC Objective M4.0: Ensure that GRC information technology provides an open yet secure exchange of information, is consistent with Agency technical architectures and standards, demonstrates a projected return on investment, reduces risk, and directly contributes to mission success

GRC Milestones supporting these Goals and Objectives:
M4.1: IT Inventory Obsolescence Process
Facilitate and coordinate the IT obsolescence process so that the average age of the GRC interoperable or networked computer systems does not exceed three years and that no GRC IT equipment is older than seven years. [4Q; 7100/J.Oprea]

M4.2: ODIN Customer Satisfaction
Fully satisfy (obtain a rating of at least four on a five-point scale) at least 95% of all GRC IT users who respond to Outsourcing Desktop Initiative for NASA customer surveys. [4Q; 7100/D.Sosoka]

M4.3: IT Security Plan
Ensure that all GRC Information Technology systems have an IT Security Plan. [4Q; 7100/P.Kotlenz]



MS Objective 5: Invest wisely in our use of human capital, developing and drawing upon the talents of all our people.

MS Performance Goal 2MS7: Align management of human resources to best achieve Agency strategic goals and objectives.

MS Performance Goal 2MS8: Attract and retain a workforce that is representative at all levels of America's diversity.

GRC Objective M5.0: Effectively and economically manage GRC's human resources. This includes taking steps to have a workforce representative of America's diversity, and reducing Equal Employment Opportunity complaints through use of the Informal Alternative Dispute Resolution Process.

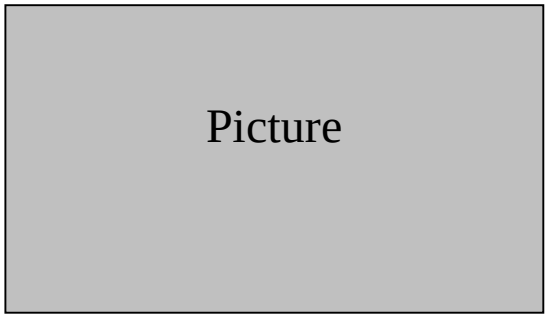
GRC Milestones supporting these Goals and Objectives:

M5.1: Understanding and Meeting OHR Customer Needs
Establish a baseline and cycletime for processes and services provided by the GRC Office of Human Resources. [2Q; 0400/R.Bailer]

M5.2: Workforce Diversity
Maintain a diverse workforce where women, minorities, individuals with disabilities, and disabled veterans are represented at all levels. Targets are to increase the representation of minorities by at least 0.4%, of women by at least 0.2%, and individuals with disabilities and disabled veterans by at least 0.1%. [4Q; 0180/R.Romero]

M5.3: Hiring and Promoting within Underrepresented Groups
Ensure that progress in hiring and promoting women, minorities, individuals with disabilities, and disabled veterans has been made at GRC compared with FY2001. [4Q; 0180/R.Romero]

M5.4: ADR Process
Ensure that at least 85% of all informal Equal Opportunity complaints are resolved using the Informal Alternative Disputes Resolution Process (counseling or mediation). [4Q; 0180/R.Romero]



Provide Aerospace Products and Capabilities (PAPAC)

PAPAC Goal 1: Enable NASA's strategic Enterprises and their centers to deliver products and services more effectively and efficiently.

PAPAC Objective 1: Enhance program safety and mission success in the delivery of products and operational services.

PAPAC Performance Goal 2P1: Meet schedule and cost commitments by keeping development and upgrade of major scientific facilities and capital assets within 110 percent of cost and schedule estimates, on average.

GRC Objective P1.0: Develop and maintain a comprehensive R&D risk management methodology. Ensure that GRC's risk management methodology and all program and/or project risk management plans comply with NASA Policy Directive 7120.4 and NASA Procedures and Guidelines 7120.5 and that they address safety, environmental compatibility, and security. Utilize the Mission Assurance Program to improve the quality, timeliness, and cost-effectiveness of the development and acquisition of research products and services by making risk management training, orientation, and implementation support available to all GRC program and project personnel.

GRC Milestones supporting these Goals and Objectives:
P1.1: CRM Implementation
Implement the GRC Continuous Risk Management Implementation Plan for at least twelve GRC programs or projects. [4Q; 0500/S. Hardy]

P1.2: Mission Assurance Tools
Complete the development of the Process-Based Mission Assurance tools and techniques, incorporate them with Agency-wide examples and lessons learned in a web-based toolkit, and complete GRC implementation visits associated with these tools and techniques. [4Q; 0500/S. Hardy]

PAPAC Objective 2: Improve NASA's engineering capability to remain as a premier engineering research and development organization.

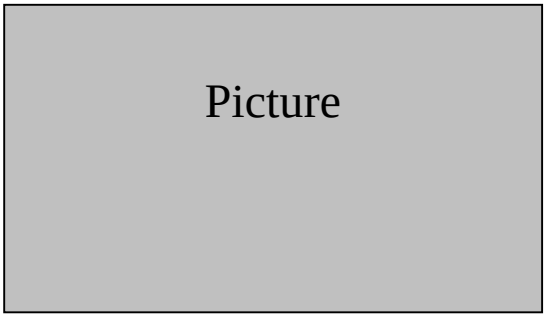
GRC Objective P2.0: Enhance GRC's critical research capabilities.

GRC Milestones supporting these Goals and Objectives:
[None for FY2002]

PAPAC Objective 3: Capture and preserve engineering and technological best practice to continuously improve NASA's program/project management.

GRC Objective P3.0:
[Same]

GRC Milestone supporting these Goals and Objectives:
[None for FY2002]



PAPAC Objective 4: Facilitate technology insertion and transfer, and utilize commercial partnerships in research and development to the maximum extent practicable.

PAPAC Performance Goal 2P6: Dedicate 10 to 20 percent of the Agency's Research and Development budget to commercial partnerships.

GRC Objective P4.0: Form alliances and partnerships with other NASA centers, federal, state, and local agencies, academia, and industry

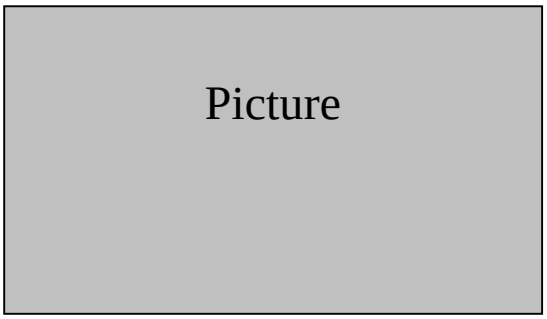
GRC Milestones supporting these Goals and Objectives:

P4.1: GRC Parterships*
Dedicate 10 to 20 percent of GRC's research and development budget to partnerships with commercial potential. [4Q; 9400/L.Viterna]

P4.2: Garrett-Morgan Commercialization Initiative
Transfer at least three GRC technologies to small minority or women-owned businesses via the Garrett-Morgan Commercialization Initiative. [4Q; 9400/L.Viterna]

P4.3: NASA-Illinois Commercialization Center
Transfer at least five GRC technologies via the NASA-Illinois Commercialization Center. [4Q; 9400/L.Viterna]

P4.4: SBIR/STTR Programs
Manage at least 10% of the Agency's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) funding. [4Q; 9400/L.Viterna]



Generate Knowledge (GK)

[There are no Agency-wide goals, objectives or performance goals for this cross-cutting process. Accordingly, this year GRC has no objectives or milestones for this cross-cutting process.]

Communicate Knowledge (CK)

CK Goal 1: Ensure that NASA's customers receive the information from the Agency's efforts in a timely and useful form

CK Objective 1: Share with the public the knowledge and excitement of NASA's programs in a form that is readily understandable.

CK Performance Goal 2CK1: Share the experience of expanding the frontiers of air and space with the public and other stakeholders by meeting 4 of the following 5 indicators:

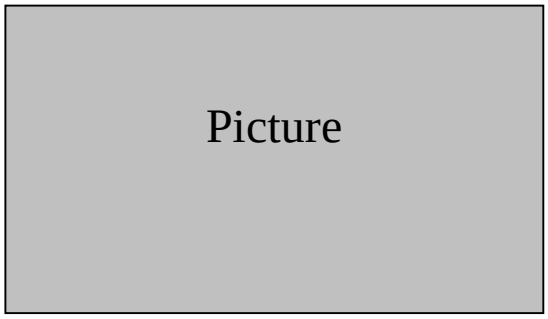
- **1A-** More Americans can visit a NASA exhibit, through a minimum of 350 events per year.
- **1B-** Public attendance and participation in the NASA Art Program will increase, thought exhibitions in 15 additional states.
- **1C-** Agency officials and astronauts will convey clear information on NASA activities though the most-used media in America- television- through no less than 20 live shots per month on average.
- **1D-** NASA's activities and achievements will be chronicled and put into perspective for the American public, though 10 new historical publications.
- **1E-** Documents significant in the Agency's history will be made available to a larger audience by producing one, new electronic document- a CD/ROM

GRC Objective C1.0: Ensure widespread recognition of GRC's capabilities and technologies; enhance GRC's image by communicating its expertise internally and externally; and increase public awareness of GRC's contributions.

GRC Milestones supporting these Goals and Objectives:
C1.1: Centennial of Flight Exhibit
Develop an exhibit fabrication and management plan for the Center's and the Agency's participation in the 2003 Centennial of Flight celebration. [2Q; 9300/L.D.Campbell]

C1.2: Center Director Forums
Develop and implement expanded manager and employee forums with the Center Director. [4Q; 9300/L.D.Campbell]

C1.3: News Release Imagery
Increase efforts in the area of visual imagery to identify still photographs and video to the media and place on the web. [4Q; 9300/L.D.Campbell]



CK Objective 2: Disseminate scientific information generated by NASA programs to our customers.

GRC Objective C2.0: Disseminate scientific and technical information generated by GRC activities to GRC customers and beneficiaries.

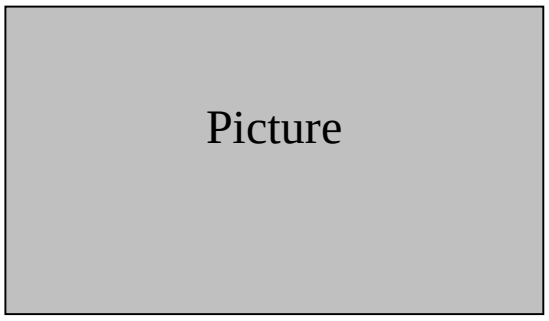
GRC Milestones supporting these Goals and Objectives:

C2.1: TechTracS*
Provide at least 40 new NASA TechTracS technology records that will be publicly accessible via the Internet. [4Q; 9400/L.Viterna]

C2.2: TOPS
Generate at least 8 Technology Opportunity Sheets (TOPS) to market the capabilities, facilities and technologies of GRC. [4Q; 9400/L.Viterna]

C2.3: Success Stories
Research and release to the public at least 20 stories of successful technology transfer. [4Q; 9400/L.Viterna]

C2.4: Technology Commercialization Articles
Publish at least 30 articles relating to technology commercialization activities in publications such as Innovation, and Spinoff. [4Q; 9400/L.Viterna]



CK Objective 3: Transfer NASA technologies and innovations to private industry and the public sector.

CK Performance Goal 2CK3: Ensure consistent, high-quality external communication by meeting 3 of the following 4 indicators:

- **3A-** Effectively communicate technologies available for commercial use and technologies that have been commercialized by industry, through specific publications.
- **3B-** Publish at least one industry-specific, special edition of *Aerospace Technology Innovation* issue to attract new readership and encourage partnerships with targeted industry sectors.
- **3C**- Carry out effective NASA technology transfer market outreach to the medical device industry.
- **3D**- The NASA *TechTracS* database, accessible through the Internet, will list at least 18,000 NASA technologies that are considered to be of benefit to U.S. industry and the public.

GRC Objective C3.0: Support the Agency's efforts to improve technology transfer by insuring that GRC's best practices are communicated to other NASA Centers.

GRC Milestones supporting these Goals and Objectives:

C3.1: Space Act Agreement and Software Release Processes
Work with at least 6 NASA Centers to streamline the Agency's Space Act Agreement documentation and Software Release processes. [4Q; 9400/L.Viterna]

CK Objective 4: Support the Nation's education goals.

CK Performance Goal 2CK4: Using NASA's unique resources (mission, people and facilities) to support educational excellence for all, NASA will meet3 of the following 4 indicators:

- **4A-** Provide excellent and valuable educational programs and services, maintaining an "excellent" customer service rating ranging between 4.3 and 5 (on a five-point scale) 90% of the time.

GRC Objective C4.0: Expand and enhance GRC science, mathematics, and engineering educational programs and public outreach. To accomplish this, GRC will align its educational programs with the framework described in the NASA Implementation Plan for Education 1999 to 2003.

GRC Milestones supporting these Goals and Objectives:

C4.1: Teacher Preparation and Skill Enhancement
Conduct an event that will systemically link teachers, students and parents in an on-going educational program. [4Q; 9200/J.Charleston]

- **4B-** NASA will involve the educational community in its endeavors, maintaining a level of involvement of approximately 3 million participants, which include teachers, faculty and students.
- **4C-** Through partnerships, NASA will increase the amount of total funding obligations from the FY2000 baseline for Historically Black Colleges and Universities and Other Minority Universities.
- **4D-** NASA will establish an undergraduate scholarship program.

C4.2: Student Support
Increase the number of underrepresented minority and underserved students participating in NASA student programs. [4Q; 9200/J.Charleston]

C4.3: Curriculum Support
Develop instructional materials to support the 100th Anniversary of Powered Flight. [4Q; 9200/J.Charleston]

C4.4: Education Technology 1
Serve as the Educational Lead Center for the Aerospace Technology Enterprise to coordinate the 100th Anniversary of Powered Flight. [4Q; 9200/J.Charleston]

C4.5: Education Technology 2
Utilize webcast technologies to increase the number of students and teachers participating in educational programs to highlight NASA GRC programs. [4Q; 9200/J.Charleston]

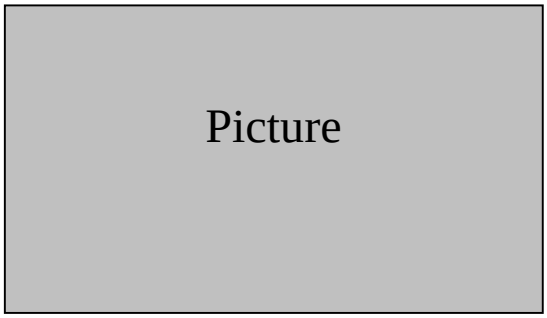
C4.6: Education Technology 3
Increase the number of methods that technology can be used to reach students and teachers by investigating the use of emerging high-level video-conferencing technologies with at least one out-of-state school. [4Q; 9200/J.Charleston]

C4.7: Systemic Improvement 1
Integrate five new Science, Engineering, Mathematics and Aerospace Academy (SEMAA) sites into the National SEMAA Program. [4Q; 9200/J.Charleston]

C4.8: Systemic Improvement 2
Upgrade and install new Microgravity curricula in NASA's 22 Aerospace Education Laboratories. [4Q; 9200/J.Charleston]

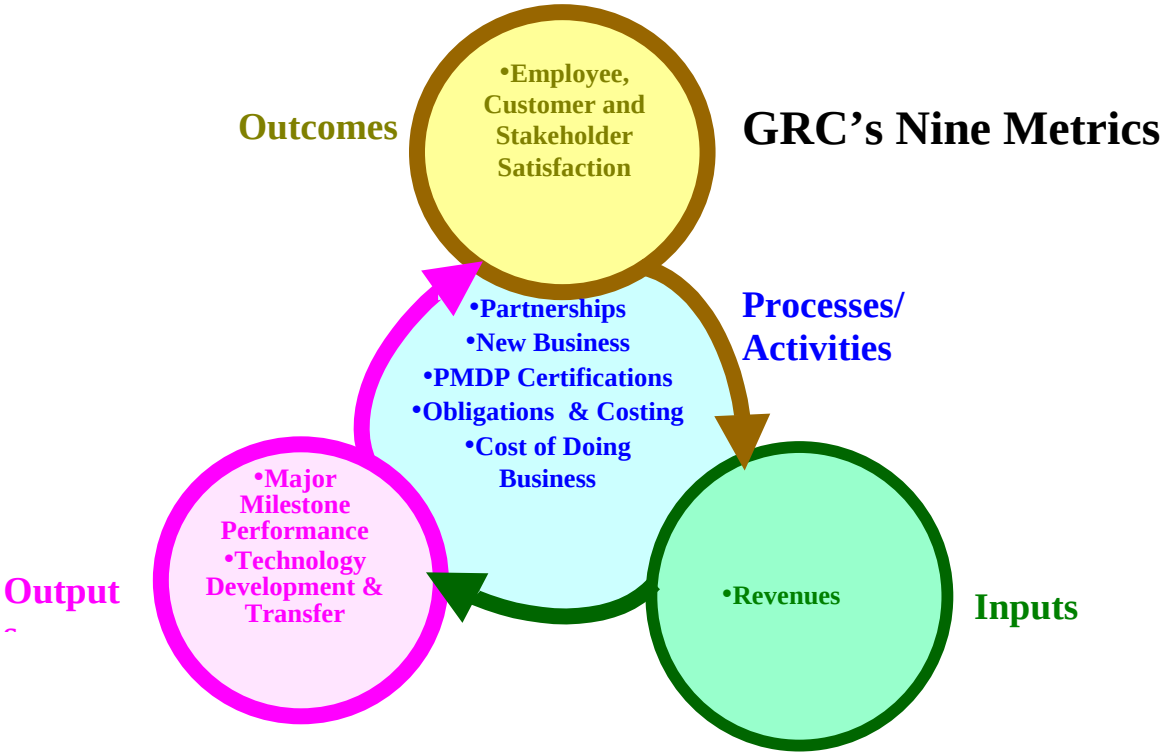
C4.9: Systemic Improvement 3
Conduct Phase II of the Aerospace Education Center feasibility study. [4Q; 9200/J.Charleston]

C4.10: Educational Program Management
Work with GRC Aerospace Enterprise Project Offices to develop Education outreach metrics. [4Q; 9200/J.Charleston]



GRC Center-Level Metrics

GRC has nine metrics to monitor the overall health of the Center. These metrics are reviewed by GRC management on a quarterly basis and also at the Annual Center Performance Review.



Revenues- Tracks the balance of the Center's revenue portfolio and the distribution of funding received from NASA Enterprises, other government agencies, and non-federal entities.
Partnerships- Counts the number of partnerships GRC has established with businesses, educational and non- profit organizations, and non-federal entities.
New Business- Tracks the new opportunities being pursued by GRC, the cost to GRC of pursuing them, and the value of the new business captured.
Program Management Development Program (PMDP) Certifications- Counts the number of GRC employees who have achieved PMDP certification at the four designated levels. Each GRC directorate has established certification goals to meet anticipated program management needs.
Obligations and Costing- Measures GRC obligations and costing, both planned and actual. GRC's goal is to be within 2 percent of the plan for each area monitored and for all areas in aggregate.
Cost of Doing Business- Compares the percentage of funds GRC spends for direct costs, service pool costs, and general and administrative costs.
Major Milestone Performance- Measures the cost, schedule and technical performance of all milestones in the GRC Strategic Implementation Plan. GRC's goal is to complete at least 85 percent of all milestones on schedule and within budget while accomplishing their technical objectives.
Technology Development and Transfer- Counts the number of GRC new technology disclosures, refereed journal articles, patents, patent licenses and major awards.
Employee, Customer and Stakeholder Satisfaction- Measures GRC's overall success in meeting the needs of these three key groups. This is GRC's keystone metric.

Appendix A
GRC Program Points of Contact

NASA Safety Initiative
Manuel B. Domingue (216) 433–6735

Aerospace Technology Enterprise
Aerospace Propulsion and Power Program
Research and Technology
Gary T. Seng (216) 433–3732
CICT Research and Technology
Gary T. Seng (216) 433-3732
Ultra-Efficient Engine Technology
Robert Shaw (216) 977–7135
Aviation Safety Project Office
Jai-won Shin (216) 433–8714
HPCC and Information Technology R&T (Aerospace Propulsion Design Tools)
John Lytle (216) 433–3213
Flight Research R&T (ERAST Sensors)
David Bents (216) 433–6135
Airframe Systems R&T (21st Century Aircraft Propulsion)
Leo Burkardt (216) 433-7021
Airframe Systems R&T (System Study and Analysis)
Timothy Wickenheiser (216) 977–7111
Advanced Space Transportation Technology Program
Harry Cikanek (216) 433–6196
Breakthrough Propulsion Physics Project
Marc Millis (216) 977–7535
Advanced Communications
Konstantinos Martzaklis (216) 433–8966
Space Communications Project
Kul Basin (216) 433–3676

Human Exploration and Development of Space Enterprise
International Space Station (ISS) Electrical Power
John Dunning (216) 433–5298
ISS: Fluid and Combustion Research Facility Development and Utilization
Thomas St. Onge (216) 433–3557
Space Operations Program
Pete Vrotsos (216) 433–3560
Shuttle Upgrades
William Taylor (216) 433–6568
Exploration Initiatives
Power
Steven D. Johnson (216) 433–5370
Advanced Space Transportation
Stanley Borowski (216) 977–7091

Biological and Physical Research Enterprise
Microgravity Science Program
Jack Salzman (216) 433-2868
Fluid Physics
Fred Kohl (216) 433–2866
Combustion Science
Thomas Sutliff (216) 433–3887
Acceleration Measurement
David Francisco (216) 433–2653

Space Science and Earth Science Enterprises
Power
Raymond Burns (216) 433–5360
In-Space Propulsion
John Dunning (216) 433–5298
Earth Science Technology Program
Robert Bauer (216) 433–3431

Cross-Enterprise Technology Development Program Thrust Area Management
Advanced Power and On-Board Propulsion
Joseph Nainiger (216) 977–7103
High-Rate Data Delivery
Kul Bhasin (216) 433–3676

On Behalf of all NASA
Spectrum Management
Wayne Whyte (216) 433–3482
Workgroup Hardware and Software
William Naiman (216) 433–9330
Aeronautics Exhibits
David DeFelice (216) 433–5538
Environmental Information Systems
Daniel White (216) 433–3103
Information Technology Security Awareness Training
Richard Clapper (216) 433–2890

Appendix B
GRC Organizational Points of Contact

Office of the Director
Director
Donald J. Campbell (216) 433–2929
Deputy Director
Gerald J. Barna (Acting) (216) 433–5308
Deputy Director for Operations
Julian M. Earls (216) 433–3014
Chief Scientist
Marvin E. Goldstein (216) 433–5825
Assistant Deputy Director for Policy
John W. Gaff (216) 433–2940

Chief Counsel
William Sikora (216) 433–2318

Aeropropulsion Research Program Office
Gary T. Seng (216) 433–3732

Inspector General
Chester A. Sipsock (216) 433–8960

Systems Management Office
Olga Gonzalez-Sanabria (216) 433–5252

Equal Opportunity
Robert Romero (216) 433–5538

Chief Financial Officer
Robert E. Fails (216) 433–2977

Office of Human Resources
Rick J. Bailer (216) 433–2481

Safety and AssuranceTechnologies
Vernon W. Wessel (216) 433–2350

Environmental Management Office
Michael Blotzer (216) 433–8159

Acquisition
Bradley J. Baker (216) 433–2800

Aeronautics Directorate
Director
Arun K. Sehra (216) 433–2965

Research and Technology Directorate
Director
Woodrow Whitlow, Jr. (216) 433–3193
Deputy Director
Lawrence J. Bober (216) 433–3944

Space Directorate
Director
Rudolph L. Saldana (Acting) (216) 433–2970
Deputy Director
Rudolph L. Saldana (216) 433–2970

Engineering and Technical Services Directorate
Director
Randall B. Furnas (216) 433–2321
Deputy Director
Jose M. Vega (216) 433–5453

Plum Brook Management
Robert P. Kozar (419) 294–3236

Chief Information Officer
Sasi K. Pillay (216) 433–9300

External Programs Directorate
Director
John M. Hairston, Jr. (216) 433–8686
Educational Programs
Jo Ann Charleston (216) 433–2957
Community and Media Relations
Linda Dukes-Campbell (216) 433–8920
Commercial Technology
Larry Viterna (216) 433–2966

For more information about this Plan,
Contact
GRC Plans and Programs Office

Telephone: (216) 433–8567
E-mail: implement@grc.nasa.gov

or
Visit the Glenn Web Site at

http://www.grc.nasa.gov/www/Strategic_Implementation/